ABSTRACT

The present study on the structure and behaviour of vascular cambium and its derivatives tissues - the food conducting (secondary phloem) and the water conducting (secondary xylem) pathways has been undertaken in relation to different weather conditions of the study site and age of the selected trees Ceiba pentandra (L.) Gaertn., Ficus glomerata Roxb. and Moringa oleifera Lamk. for two consecutive years (2003 & 2004). The findings are summarized as follows:

The vascular cambium is semi-stratified in C. pentandra, typical non-stratified in F. glomerata and M. oleifera. It forms a continuous cylinder and is made up of fusiform and ray initials. The fusiform initials are found to vary in length from 212.50 - 712.50 μm in C. pentandra, 150.00 - 612.50 μm in F. glomerata and 125.00 - 437.50 μm in M. oleifera. The fusiform initials undergo considerable size variation with growing girth of the stem axis. The length of fusiform initials shows an increasing trend from top toward the base of the tree in C. pentandra and in F. glomerata initially it increases and exhibit declining trend at the base while in M. oleifera the length exhibit increasing tendency with the advancing age and soon gets stabilized near the base. This increase in length goes up
to 24% in *C. pentandra*, 23% in *F. glomerata* and 46% in *M. oleifera* respectively.

The ray initials multiply to become more in number as the trunk grows older and wider. New rays arise either by cutting off tips or sides of fusiform initials or by transverse segmentation of the latter.

The wood is diffuse porous in all the three species investigated. The pores are either solitary or in radial multiples of 2-12.

The average length of vessel elements shows an increase with the increasing girth of the axis in *C. pentandra*. In *F. glomerata* and *M. oleifera*, average length of vessel elements initially increases with the age and after experiencing a slight decline again there is a gain in length with the advancing age. The radial and tangential diameter of vessel elements in *C. pentandra* and *F. glomerata* first undergo expansion with increasing age of the axis which is followed by a declining tendency near the basal regions. In *M. oleifera* radial diameter shows an initial increase and appear to be followed by constancy while tangential diameter shows an increasing tendency from top towards the base. The length of vessel elements vary from 100.00-500.00 μm in *C. pentandra*, 62.50-
525.00 μm in F. glomerata and 125.00-400.00 μm in M. oleifera in different months of a calendar year with average length of vessel elements is measured 353.46 in C. pentandra, 264.00 μm in F. glomerata and 279.04 μm in M. oleifera under different seasonal influences.

The mean length of xylem fibres shows a positive increase with growing size of the trunk and the average length of fibres has been found to vary from 1134.00-1828.00 μm in C. pentandra, 1031.50-1416.00 μm in F. glomerata and 571.00-736.00 μm in M. oleifera.

The bark as usual is made up of three distinct zones viz, conducting phloem, non-conducting phloem and periderm. The sieve-tube members possess mostly oblique sieve plates on their end wall in C. pentandra, slightly oblique to transverse in F. glomerata and mostly transverse in M. oleifera. They vary in length from 162.50-450.00 μm in C. pentandra, 150.00-412.50 μm in F. glomerata and from 187.50-400.00 μm in M. oleifera and their average length is measured 324.42 μm, 266.08 μm and 269.29 μm respectively due to seasonal influence. They occupy about 28% transactional area in C. pentandra, 25% in F. glomerata and 27% in M. oleifera.
A gradual increase in the length of sieve-tube members along the tree axis of varying girth has been observed in *C. pentandra* and *M. oleifera*, while it declines near the base in case of *F. glomerata*.

The phloem fibres are distributed in the secondary phloem in a characteristics pattern in *C. pentandra*, *F. glomerata* and *M. oleifera*. They grow in length 2.427-4.298 times over the length of their mother initials in the different species investigated. They vary in length from 650.00-2500.00 \( \mu \text{m} \) in *C. pentandra*, from 625.00-2300.00 \( \mu \text{m} \) in *F. glomerata* and from 250.00-1300.00 \( \mu \text{m} \) in *M. oleifera* in different months of a calendar year.

The activity of vascular cambium initiates at different times in different species. Swelling of cambial cells occur in early May in *C. pentandra*, in mid-January in *F. glomerata* and in early June in *M. oleifera*. The cells begin to divide in mid May in *C. pentandra*, in late January in *F. glomerata* and in mid June in *M. oleifera*.

The cambium turns dormant in late November in *C. pentandra* and *M. oleifera* while in *F. glomerata* dormancy is attained in late September. The total amount of xylem produced in measures about 1950 \( \mu \text{m} \) in *C. pentandra*, 2150
μm in *F. glomerata* and 1600 μm in *M. oleifera*. In *C. pentandra* and *F. glomerata* the newly produced derivatives differentiate first into phloic elements, but in *M. oleifera*, the newly produced derivatives differentiate into phloic as well as xylem elements simultaneously.

The phloem production takes place in the months of May, June and July in *C. pentandra*, in January, February and July in *F. glomerata* and in June, July, August, September and November in *M. oleifera*. Precursor phloem is noticeable in *C. pentandra* in the month of January. The total amount of phloem produced during a calendar year is about 645 μm and 150 μm precursor phloem in *C. pentandra*. In *F. glomerata* and *M. oleifera*, the phloem production is about 260 μm and 430 μm respectively. The cambium remains active for about 7 months in *C. pentandra*, 9 months in *F. glomerata* and 6 months in *M. oleifera*.